UNIT OVERVIEW

ENERGY

Unit Issue: Energy-efficiency and energy use.

Anchoring Phenomenon: Some energy transfers and transformations are more efficient than others.

Listed below is a summary of the activities in this unit. Note that the total teaching time is listed as 22-35 periods of approximately 45 to 50 minutes (approximately 5-7 weeks). If you find you cannot finish in this time frame, consider skipping activities 9 and/or 12.

Activity Description	Topics	Advance Preparation	Assessment	Teaching Periods
1. **Investigation: Home Energy Use** Students brainstorm the uses of energy in the home and become aware of everyday energy consumption. They compare the features of two homes and suggest which one consumes less energy. Students then develop an operational definition of energy-efficiency.	Energy, energy use, energy-efficiency, trade-off SENSEMAKING	Prepare Student Sheets.	E&T QUICK CHECK A5	1–2
2. **Laboratory: Drive a Nail** Students explore how they can tranck the transfer of energy by designing and conducting an experiment to drop metal rods of different masses from different heights to drive a nail into a foam block. They discover the relationship btween gravitational potential energy and both mass and height, and they quantify the transformation of gravitational potential energy to kinetic energy	Kinetic energy, potential energy, gravitational potential energy, energy transfer and transformation, variables LITERACY		PCI Proc.	2–3
3. **Role Play: Roller Coaster Energy** Students further examine energy transformations between gravitational potential energy and kinetic energy in the context of a common experience—namely, roller coasters. Students are introduced to the idea that some energy is transformed into thermal energy and sound during energy transformations.	Kinetic energy, potential energy, energy transfer and transformation	Prepare Student Sheet.	EXP A1	1–2
4. **Investigation: Shake the Shot** Students further investigate energy transfer and transformation. They transfer kinetic energy to a system of metal shot in a container and explore the resulting energy transformation by measuring temperature change. The investigation introduces the relationships between motion, temperature, and thermal energy.	Energy transfer and transformation, heat, temperature, thermal energy	Fill shakers.	AID A3	1–2

ENERGY (continued)

Activity Description	Topics	Advance Preparation	Assessment	Teaching Periods
5. **Reading: Conservation of Energy** Students are introduced to the fundamental principle of energy—the law of conservation of energy. They learn that almost all energy transformations involve the process of heating, in which some energy is transformed to thermal energy. People usually consider this energy as "lost" since it is often no longer useful to them. Students are introduced to the idea of efficiency in a transformation.	Absorption and release of energy, law of conservation of energy, energy-efficiency, conserving energy SENSEMAKING	Prepare Student Sheet.	ARG QUICK CHECK A3	1–2
6. **Investigation: Follow the Energy** Students continue to explore the consequences of the law of conservation of energy by analyzing specific energy transfers and transformations. Students focus on different energy types through examples of transformations that either absorb or release energy.	Energy types, following energy transformation and transfer SENSEMAKING	Prepare Student Sheet.	ARG A3 (Summative Assessment)	2–3
7. **Laboratory: Mixing Hot and Cold Water** Students investigate thermal energy transfer between water samples of different volumes and temperatures. To start, students predict the results of mixing water samples of different temperatures. They then test their predictions through experimental measurement of the temperatures of the mixtures as they reach thermal equilibrium. Lastly, students explain their results by applying their understanding of thermal energy transfer.	Energy transfer	Provide supply of hot and cold water.	EXP A2	2
8. **Laboratory: Thermal Energy Storage** Students design and conduct an investigation to determine the relationship between the mass, type of material, and temperature change when substances at different initial temperatures are combined.	Energy transfer, storage and release of thermal energy	Provide supply of hot and cold water.	PCI Proc. (Summative Assessment)	2
9. **Reading: Energy Across the Sciences** Students read about energy transfers and energy transformation in several different examples, keeping track of this information as they read. They summarize what all of the examples have in common by writing a blurb that could go on the back of a science textbook about energy.	Energy transformation and transfer (and efficiency) LITERACY	Prepare Student Sheet.	COM QUICK CHECK A2	1–2

ENERGY (continued)

Activity Description	Topics	Advance Preparation	Assessment	Teaching Periods
10. **Design: Energy Transfer Challenge** Students explore thermal energy transfer (heat) by coming up with, designing, and testing one process and structure to melt as much ice as possible and another to allow as little ice to melt. They then use the data collected to compare and analyze the effectiveness of their designs and analyze variables that affect the transfer of thermal energy.	Energy transfer, transformation (and efficiency), engineering design	Gather ice cubes and optional insulating materials.	ENG Proc., A4 QUICK CHECK A5	2–3
11. **Laboratory: Energy in Light** Students measure, compare, and analyze the temperature change experienced by different materials when exposed to the same amount of sunlight.	Energy transfer, transformation, absorption, (and efficiency)	Gather graph paper and trays.	AID A1	1–2
12. **Reading: Conduction, Convection, and Radiation** Students read about thermal energy transfer. They are introduced to the terms convection and radiation and compare the three methods of thermal energy transfer. The Listen, Stop, and Write literacy strategy helps students comprehend the ideas presented in the text.	Energy transfer, conduction, convection, radiation, insulation LITERACY		EXP A3	1–2
13. **Design: Maximizing Solar Energy Transfer** Students design, test, evaluate, and redesign a solar heater.	Energy transfer, transformation, reflection, (and efficiency), engineering design	Prepare a supply of room temperature water, gather optional materials.	ENG Proc. (Summative Assessment)	2–3
14. **Laboratory: Hot Bulbs** Students compare the amount of thermal energy transferred by a small incandescent and LED light bulb. They use their measurements to calculate the efficiency of the bulbs to produce light by measuring how much "wasted" energy is "lost" in producing thermal energy. They also compare "lifetime" costs for different types of bulbs. Finally, students consider the trade-offs involved when deciding which type of bulb to purchase.	Energy transfer, transformation, and efficiency	Obtain fresh 9–volt batteries, check bulb harness setups, and prepare a supply of room temperature water.	E&T A4	1–2

ENERGY (continued)

Activity Description	Topics	Advance Preparation	Assessment	Teaching Periods
15. **Problem Solving: Improving Home Energy-Efficiency** Students gather more information about the factors that affect energy use and efficiency because of how they affect energy transformation. They use their knowledge of energy concepts and an economic analysis to make energy-saving recommendations that meet the needs of families in fictional scenarios. Their analyses calculate the time it takes for energy improvements to pay for themselves and the savings over 10 years. Students present the trade-offs of their home energy-efficiency plans in their recommendations.	Energy-efficiency, home improvements	Prepare Student Sheets.	COM A1 E&T A1	2–3